

The Role of Confidence in the Truthful Revelation of Private Values

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Abstract

Recent research shows that the disparity between WTP and WTA disappears with market experience and training. In effect, preferences can be refined by eliminating misconceptions. Critics however, state that market feedback and training may shape rather than refine preferences. This paper explores the use of a stated measure of confidence as a proxy for misconceptions. The results indicate that confidence matters for buyers and sellers in a BDM auction. With confidence, WTA and WTP measures converge. In addition, people with higher confidence choose the dominant bidding strategy more frequently for both WTA and WTP in BDM auctions.

“All you need in this life is ignorance and confidence; then success is sure.”

~ *Mark Twain*

Introduction

The debate concerning the disparity between willingness to pay and willingness to accept has been ongoing for over thirty years (for an overview of the literature see Horowitz and McConnell, 2002; Sayman and Oncular, 2005). A common explanation for this violation of neoclassical theory has been the “endowment effect” (Kahneman, Knetsch and Thaler, 1990, 1991). The endowment effect states a person’s WTP to purchase a good is less than the amount she would have to be compensated to give up the good if in her possession. In contrast, researchers on the other side of the debate state the disparity is a byproduct of strategic bias (Knez et al., 1985; Loomes et al., 2003).

Strategic bias suggests that when eliciting individual’s willingness to accept (WTA) to relinquish the property rights to a good or service people will set their minimum WTA above their true value. When eliciting willingness to pay (WTP), strategic bias suggests people will set their maximum WTP below their true value (Knez et al., 1985; Loomes et al., 2003). In an effort to eliminate strategic bias, researchers have utilized incentive compatible mechanisms to elicit values (Kahneman et al., 1990; Shogren et al., 2001; Knetsch et al., 2001; Noussair et al., 2004). However, strategic bias can persist in institutions even when employing incentive compatible mechanisms in which the weakly dominant strategy is to truthfully reveal ones true value (Brown, 2005).

The 2nd price Vickrey auction (Vickrey, 1961) and the Becker-DeGroot-Marschak (BDM) mechanism (Becker, DeGroot, Marschak, 1964) are two methods commonly used in the

experimental lab to elicit individuals' willingness to pay (WTP) and willingness to accept (WTA) values for environmental and neoteric goods. The attractiveness of the BDM and 2nd price auction is both have a weakly dominant strategy of truthful revelation of an individual's value (Noussair et al., 2004).¹ However, both the Vickrey 2nd price auction and the BDM mechanism are rarely encountered outside the experimental lab (Bohm et al., 1997; Lucking-Riley, 2000; Lusk, 2003). People participating in economic experiments will likely be unfamiliar with the allocation rules underlying the 2nd price auction or BDM mechanism.

If people do not understand the elicitation mechanism, their misconceptions may reveal themselves as strategic bias. In the presence of confusion or a lack of confidence in their understanding of the institution, people tend to revert to what they know (Samuelson and Zeckhauser, 1988).² If procedures are implemented to train away misconceptions, then WTA will equal WTP for some normal goods (Plott and Zeilor, 2005, 2011; Isoni et al., 2011; Kovalchik et al., 2005). However, training procedures to eliminate misconceptions may impose the preferences of the researcher on the preference ordering of the subjects biasing the results (Sugden, 2009).

Additionally, misconceptions can be disciplined away through market experience (Coursey et al., 1987). Evidence of convergence in WTP and WTA exists for endogenous market experience through repeated rounds of bidding (Coursey et al., 1987; Shogren et al., 1994; Morrison, 2000; Loomes et al., 2003, 2010; List, 2003, 2004) or for exogenous market experience that subjects have previously acquired or obtain external to the experimental lab (List, 2011). Market experience obtained through repeated rounds refine preferences, but may also

¹ The BDM mechanism is not incentive compatible even when the resale value of the good being considered is known with certainty if the utility function is not independent of the price distribution (Horowitz, 2006).

² The status quo bias would suggest that if the person is uncertain of the market mechanism, the person will revert to the status quo mechanism—traditional market where bid is not separated from price (buy high, sell low).

shape preferences as people respond to prior period price signals (Loomes et al., 2003; Isoni et al., 2011; Braga et al., 2009).

The open question is can we control for market misconceptions without shaping preferences. One possible proxy for mechanism understanding is an individual's stated comfort as a buyer or as a seller. Engelmann and Hollard (2010) indicate that as individuals gain a better understanding of the costs and benefits associated with making transactions through forced trade, the endowment effect disappears. Forced trade appears to reduce trade uncertainty increasing the individual's confidence in beneficial outcomes. Kovalchik et al. (2005) show confidence and correct responses to be positively correlated. Although some overconfidence was evident, those individual that were completely confident reported correct responses in more than 92% of the trials (Kovalchik, 2005). Further, market decisions are more consistent for individuals with higher confidence levels (Thomas and Menon, 2007).

Herein we test the influence of confidence on truthful revelation of induced values in WTP and WTA auctions using the BDM mechanism (Becker, DeGroot, Marschak, 1964). Subject's stated personal perception of own comfort in the role as a buyer or as a seller is used as a proxy for confidence. A strategic information sheet illustrating returns across different market prices for a given value is provided to the subjects in an effort to eliminate misconceptions. Our results indicate that confidence matters when eliciting values in both WTA and WTP auctions. With confidence, WTA and WTP measures converge. In addition, people with higher confidence choose the dominant bidding strategy more frequently for both WTA and WTP in BDM auctions.

Model

Consider a risk averse agent optimizing over two goods, a composite good (or money) and a coffee mug with an assigned induced value. The two goods are perfect substitutes with a constant marginal rate of substitution equal to one. The economic agent only faces a one period optimization decision in which the price for the coffee mug is determined using the BDM elicitation mechanism. However, the economic agent may possess misconceptions regarding the formulation of the price for the coffee mug. The agent's utility function is given by

$$U(M, V) = (M + C * V)^\beta \quad (1)$$

Where M is money, C is the number of traded coffee cups, V is the assigned induced value for the coffee cup, and β is a positive real number less than unity. For simplicity, we limit $C \in \{0, 1\}$. In allowing for strategic bias, the economic agent will have a distinctly different optimization problem when acting as a seller relative to a buyer. We examine each in turn.

Determination of WTP (Buyer)

To allow for strategic bias to exist for risk averse buyers it must be that the marginal rate of substitution between coffee cups and money is less than or equal to the price ratio. We represent the buyers' budget constraint as

$$I = M + C(V - f(\varphi)S + \eta) \quad (2)$$

Where M, C and V are as defined above, I is income, S is a constant positive number, and $f(\varphi)$ is a function of confidence (φ) captures the extent that strategic bias persists due to misconceptions. Further $f(\varphi)$ is decreasing with confidence (φ), such that $f(\varphi) \in [0,1]$. Define $f(\varphi^H) = 0$ and $f(\varphi^L) = 1$. η is a random component, with $E(\eta) = 0$. The buyer's maximum willingness to pay for a coffee cup is:

$$WTP = V - f(\varphi)S \quad (3)$$

In other words, an individual with the minimum level of confidence in her understanding of the pricing mechanism will understate her true WTP by S . A person with maximum confidence in her understanding of the pricing mechanism will truthfully reveal WTP.

Given a confident understanding of the pricing mechanism is a result of training and experience, then this representation of willingness to pay would explain the tendency for underbidding to disappear with repeated play and training.

Determination of WTA

To allow for strategic bias to exist for risk averse sellers, the marginal rate of substitution between coffee cups and money is greater than or equal to the price ratio. The sellers' budget constraint is represented as

$$I = M + C(V + h(\varphi)P + \eta) \quad (4)$$

Where M , C , V , and I are as defined above, P is a constant positive number representing the desired profit margin, and $h(\varphi)$ is a function of confidence (φ) that captures the extent that strategic bias persists due to misconceptions. Further $h(\varphi)$ is decreasing with confidence (φ), such that $h(\varphi) \in (0, 1)$. Define $h(\varphi^H) = 0$ and $h(\varphi^L) = 1$. η is a random component, with $E(\eta) = 0$. We represent the minimum willingness to accept for coffee cups as

$$WTA = V + h(\varphi)P \quad (5)$$

The interpretation here is a person with the minimum level of confidence in her understanding of the pricing mechanism will overstate her true WTA by P . A person with maximum confidence in her understanding of the pricing mechanism will truthfully reveal WTA.

Proposition 1: When confidence is at its highest, so that people fully understand the pricing mechanism, the disparity between WTA and WTP will disappear.

Experimental Design

Our experimental design is adapted from the experimental procedures of Kahneman, Knetsch and Thaler (1991). Participants were asked to arrive in a designated classroom at a specified time. Next, participants were given an overview experiment instruction sheet which was read out loud by the experiment monitor. Participants were then randomly assigned to roles as sellers and buyers. Sellers were given a Weber State University College of Business commemorative coffee mug. Sellers and buyers were then separated into different rooms. The remainder of our experiment had five primary components: 1) Roll specific instructions; 2) personal information; 3) market information sheet; 4) rounds, bidding, market price and profits; and 5) strategy sheet. We will discuss each in turn.³

Role Specific Instructions

Instructions specific for market role (buyer or seller) were read out loud. The instructions explained the BDM method for price determination and illustrated the market information sheet and how participants were to indicate prices at which they would engage in a transaction. A question and answer period followed. Subjects then answered a quiz and answers were verified. Following the quiz, subjects were provided an additional question and answer period. Buyers and sellers were aware that the commemorative coffee mug was a prop only, and that participants' would not be allowed keep the mug, nor would they be allowed to purchase a mug at the end of the experiment.

Personal Information

Participants were asked to complete personal information sheets at three points throughout the experiment. The first personal information sheet was administered following the role specific instructions and prior to the first round of bidding. The second personal information sheet was administered following the fourth round of bidding and prior to the strategy sheet. The

³ Complete instructions available in appendix A.

third personal information sheet was administered following the last round of bidding. The first personal information sheet acquired information regarding academic year, major, whether a participant has been a business owner and for how long, years of experience as a buyer, years of experience as a seller, comfort in the role of a buyer, and comfort in the role of a seller. The second and third personal information sheets asked for the participants' comfort in the role of a buyer, and comfort in the role of a seller.

Market Information Sheet

Subjects were provided an information sheet that contained their resale value and market information regarding the resale values of the other side of the market—buyers' resale values for sellers and sellers' resale values for buyers. Resale values were presented in four treatments—two discreet sets and two continuous sets: A) [0.25, 10]; B) [10.25, 20]; C) {2, 3, 3, 4, 4, 4, 6, 6, 6, 7, 7, 8}; and D) {12, 13, 13, 14, 14, 14, 16, 16, 16, 17, 17, 18}. Theoretically, market information should have no impact on bidding decisions in either a willingness to pay or willingness to accept auction. However, if market misconceptions regarding price determination exist, the presence of market information could impact an individuals' strategic bias. An individual armed with market information could act strategically with the erroneous belief that he or she could capture a larger portion of the gains from trade.

The information sheet also contained the set of the forty possible market prices in twenty five cent increments. Subjects were asked to place an X by all market prices at which they would be willing to make a transaction.

Rounds, Market Price and Profits

Eight rounds of bidding were conducted. Participants were provided a market information sheet. Sellers (buyers) were asked to mark with an X all prices for which they

would sell (buy) the mug. At the conclusion of each round a random price was drawn using the BDM mechanism. The price was posted and was public information. Participants then calculated the profits or losses from that rounds transactions. Calculations were checked for accuracy.

Strategy Sheet

A strategy sheet was provided to the subjects at the midpoint of the experiment (between rounds 4 and 5). The strategy sheet provided the subject with information regarding profit calculations and an exercise in which the subject calculated profit over three sets of market prices for a given resale value based on their specified roll. The strategy sheet was designed to illustrate that marking market prices below the resale values would result in losses (gains) for sellers (buyers), marking market prices above the resale values would result in gains (losses) for sellers (buyers) and marking market prices at the resale value was breakeven. In other words, the strategy sheet was designed to illuminate the BDM's weakly dominant strategy. Completing the strategy sheets was voluntary and correct answers were not disclosed.

Three sessions with a total of 53 participants (27 sellers, 26 buyers) were conducted at Weber State University in the fall semester of 2011.

Results and Discussion

Data was obtained for 53 subjects, where each subject participated in the experiment for eight periods. The resulting sample size is 424 observations. Means and standard deviations of all variables are given in Table One. We evaluate our experimental results in two steps. First, we look at the role of confidence in the truthful revelation of value in both WTA and WTP BDM value elicitation experiments by examining the ability of resale values and confidence to predict observed bids. And second, we look at the influence of experiment characteristics—confidence,

treatments, and resale value, on whether subjects used the dominant bidding behavior. Consider each in turn.

Influence of Confidence on Truthful Revelation

Theory predicts that rational bidders, who have no misconceptions about the elicitation mechanism or their role in the market, will set their bid equal to their resale value. However, if misconceptions exist bids will differ from resale values. We examine bidding behavior by estimating the following regression equation:

$$\begin{aligned} bid_{it} = & \alpha + \beta_1 VALUE_{it} + \beta_2 CONF_i + \beta_3 WTA_i + \beta_4 WTAVALUE_{it} + \\ & \beta_5 WTACONF_i + u_i + \varphi_t + \varepsilon_{it} \end{aligned} \quad (3)$$

In Eq(3), bid_{it} denotes subject i 's bid in trial t ; $VALUE_{it}$ denotes subject i 's resale value in trial t ; $CONF$ denotes subject i 's initial market role comfort level; WTA_i takes on a value of 1 when subject i is a seller and has a value of 0 when subject i is a buyer; $WTACONF_i$ is an interaction term created by multiplying $CONF$ by WTA . Thus $WTACONF_i = CONF_i$ for a seller and equals 0 for a buyer; $WTAVALUE_{it}$ interacts WTA with $VALUE$ allowing the slope to differ for sellers relative to buyers; u_i denotes subject-specific characteristics; φ_t represents trial-specific effects, including learning; and ε_{it} is iid error. The absence of misconceptions would be evidenced by truthful resale value revelation: $\beta_1 = 1, \alpha = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$. If these conditions are satisfied for the BDM elicitation mechanisms, then no disparity exists. However, if these conditions are not satisfied then a disparity does exist. If this disparity is a result of misconceptions we would expect the estimated bid to approach the resale value as confidence increases.

Turning to Table 2, the estimated coefficient on Value is 0.988 and is not statistically different from one. The constant however, has a value of -1.88 and is different from zero at the 9% significance level. The coefficient on $CONF$ takes a value of 0.242 and is different from zero at the 4% significance level. The estimated coefficient on WTA is 1.98 and is significant at

the 9% level. Additionally the coefficient on *WTACONF* is -0.211 and significant at 14% significance level. *WTAVALUE* is not significantly different from zero, meaning the slope coefficients are statistically the same when using the BDM elicitation mechanism for both WTA and WTP.

To illuminate the influence of the role of confidence on the disparity between WTA and WTP, we examine the marginal effect of the WTA elicitation mechanism holding resale value constant:

$$\frac{\partial bid}{\partial WTA} = 1.98 - 0.211WTACONF \quad (4)$$

It is clear from Eq(4) that the disparity between WTA and WTP tends towards zero as confidence increases.

Result 1. Strategic bias is evident when eliciting individual values with the BDM mechanism, but is attenuated as bidders become more confident in their roles in the BDM auction.

Influence of Experiment Characteristics on Bidding Dominant Strategy

Because our data is best described as panel data, we estimate the impact of several explanatory variables on whether a subject plays the dominant strategy, with a random effects probit model.

The random effects probit model is written as:

$$Y_{it} = \beta_0 + \beta_1 ERROR_{it} + \beta_2 TREATMENTAC_{it} + \beta_3 TREATMENTAB_{it} + \beta_4 CONF_{it} + \beta_5 WTA_{it} + \beta_6 WTACONF_{it} + \beta_7 VALUE_{it} + \beta_8 POSTTEST_{it} + U_{it} \quad (5)$$

In Eq(5) *VALUE*, *CONF*, *WTA* and *WTACONF* are the same as in Eq(3). *ERROR* = 1 if the subject *i* made any errors in completing the voluntary dominant strategy sheet designed to illuminate the weakly dominant strategy of the BDM auction mechanism, and 0 otherwise. *TREATMENTAC* = 1 if subject *i*'s was participating in treatments A or C where the market information on the distribution of resale values for the opposing market force was bound

between \$0 and \$10, and 0 otherwise. $TREATMENTAB = 1$ if subject i 's was participating in treatments A or B where the market information on the distribution of resale values for the opposing market force presented as a continuous interval, and 0 otherwise. Finally, $POSTTEST = 1$ for periods five through eight of the experiment after the strategy sheet was administered.

The error term U_{it} is the sum of two separate components, α_i and Ω_{it} . The term α_i represents the composite error term in each time period, and it is assumed that α_i is independently distributed and Ω_{it} represents the serially correlated error term across time (Woolridge, 2006). We assume the covariance between all explanatory variables and α_i equals 0. Estimated coefficients, standard errors, and marginal effects from the random effects model calculated with Limdep, version 9.0 are given in Table three.

From table three we see the estimated coefficient on $CONF$ is positive and statistically significant at the 5% significance level and the marginal effect is 0.94. The interpretation is a 1% increase in confidence results in a 0.94% increase in the probability of truthful resale value revelation. An average individual whose confidence in market role increases from an 8 to a 9 will increase the probability of truthful revelation of their resale value by 11.8%

Result 2: An individual's confidence with their role in an experimental BDM auction increases the probability of playing the dominant strategy.

From table three the coefficient on value is positive and significant with an elasticity of 0.31. A 1% increase in the market value increases the probability of truthful revelation of the resale value by 0.3%. Intuitively, the larger the resale value the larger the prize the more experimental outcomes conform to theory (Andersen et al., 2011). However, the coefficient on $TREATMENTAC$ (lower resale value treatments) is also positive and significant with an elasticity of 0.18, implying people bid more accurately when the opposing forces market information is a set of resale values of lower magnitude.

One possible explanation is when the opposing market forces resale values come from a distribution of larger magnitude, the subjects are more susceptible to strategic bias, but as their value is large relative to the values of the opposing market force, strategic bias is attenuated. Table three presents bidding across all resale values. Bids are classified as underbid (UB), truthful revelation (TR), overbid (OB) and inconsistent. Inconsistent bids are people who marked prices randomly or inconsistently. In the WTA auction, overbidding reflects strategic bias. In the WTP, underbidding is indicative of strategic bias. A two sample test of proportions does not support this conclusion ($z = 0.92$; $p\text{-value} > 0.18$); strategic bias does not occur more frequently

Result 3: The probability of playing the dominant strategy increases with the magnitude of the resale value within treatment, but decreases across treatment.

Next, from table three, the coefficient on *POSTTEST* is positive and significant with an elasticity of 0.05. Recall *POSTTEST* is the rounds following the voluntary strategic sheet designed to help subjects identify and internalize the dominant bidding strategy. Observed bidding of the dominant strategy increased following the access to training material.

Result 4: Allowing subjects to voluntarily engage in strategy sheets designed to help subjects internalize institution incentives and mechanism design increases the probability of playing the dominant strategy.

Lastly, Table 5 presents the observed frequencies of playing the dominant bidding strategy in relation to post experiment stated levels of confidence and the change in confidence (ex-poste confidence less ex-ante confidence) by market role. People who state a confidence level of 5 to 10 play the dominant bidding strategically on average more frequently than people whose confidence level is less than 5 (5% significance level). In addition, people who maintained the same level of confidence or grew in confidence as the experiment progressed

played the dominant strategy on average at a greater proportionality than did those individuals whose confidence shrunk as the experiment progressed—significant at 1% level.

Conclusion

Past research has illuminated the presence of misconceptions on the elicitation of private values in economic experiments that use incentive compatible elicitation mechanisms such as the BDM method. Recent research implementing procedural designs to correct for these misconceptions have been criticized as potentially too paternalistic. In training away misconceptions, researchers may impose their own preferences on the subjects. In this research, we control for the roll of misconceptions by having individuals state their comfort level in the role of a buyer or a seller.

Our results indicate confidence matters for the disparity between measures of WTA and WTP, as well as on the frequency in which people bid the dominant strategy. As people gain in confidence in their role within the institution as well as within the institution design, the disparity between WTA and WTP diminishes. Also, the likelihood that individuals' will truthfully reveal their private value increases.

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Table One: Means and Standard Deviations		
Variable	Mean	Standard Deviation
ERROR	0.17	0.38
TREATMENTAC	0.50	0.50
TREATMENTAB	0.50	0.50
CONF	7.35	2.23
WTA	0.50	0.50
WTACONF	3.32	3.68
VALUE	9.98	4.26
POSTTEST	0.50	0.50

Table Two: GLS (Two-Way Random Effects)	
Variable	Estimated Coefficient
Constant	-1.88** (1.00)
VALUE	0.988* (0.017)
CONF	0.242* (0.117)
WTA	1.978** (1.145)
WTAVALUE	0.006 (0.024)
WTACONF	-0.212*** (0.141)
R ²	0.93
N	208

Standard errors in parentheses

*significant at 5 percent level; **significant at 10 percent level.***significant at 15 percent level.

Table Three: Probit with Random Effects			
Variable	Estimated Coefficient	Standard Error	Elasticity
Constant	-9.39*	3.57	
ERROR	-0.40	1.12	-0.009
TREATMENTAC	2.56*	0.74	0.18
TREATMENTAB	-0.06	0.187	-0.004
CONF	0.93*	0.415	0.94
WTA	4.49	3.45	0.31
CONFSELL	-0.435	0.412	-0.20
VALUE	0.22*	0.064	0.31
POSTTEST	0.71*	0.25	0.05
Rho ^{&}	0.89*	0.45	
$X^2 = 196.20, p < .01$			

*significant at 5 percent level; **significant at 10 percent level. ***significant at 15 percent level.

[&]Rho, which measures the correlation between U_{it} and U_{is} is highly significant, verifying the importance of accounting for the panel data structure.

Table Four: Bidding Behavior								
	WTA				WTP			
Resale Value	UB	TR	OB	Incon	UB	TR	OB	Incon
2	0	8	2	2	3	8	1	0
3	6	14	3	1	3	15	5	1
4	6	26	1	1	6	24	2	0
6	1	14	3	0	2	12	2	0
7	0	8	6	0	1	12	1	0
8	2	4	0	0	1	3	1	1
N_{LV}	15	74	15	4	16	74	12	2
12	1	4	3	0	1	3	4	0
13	0	6	4	0	2	4	2	0
14	1	13	6	0	0	15	5	0
16	5	23	5	3	8	26	2	0
17	3	18	3	0	6	14	2	0
18	1	9	0	0	0	10	0	0
N_{HV}	11	73	21	3	17	72	15	0
N_T	26	147	36	7	33	146	27	2

Table 5. Dominant Strategy Play		
Auction	WTA*	WTP
Stated Confidence end of experiment		
Conf < 5	0.5625 (48)	0.00 (8)
Conf ≥ 5	0.714 (168)	0.737 (198)
Difference in dominant strategy play: p-value (two-tailed test)	< 0.05	< 0.01
Difference in stated confidence-end of experiment less beginning of experiment		
Dif < 0	0.125 (32)	0.333 (24)
Dif ≥ 0	0.777 (184)	0.758 (184)
Difference in dominant strategy play: p-value (two-tailed test)	< 0.01	< 0.01

*Percentage play of dominant strategy—sample size, n, in parenthesis